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WASHINGTON, DC 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Revision No. 2: Estimated Drinking Water Concentrations of
Ethylenebisdithiocarbamate (EBDC) Degradate Ethylenethiourea (ETU) for the
Use in Human Health Risk Assessment

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Summary

This is a revised memo presenting the Estimated Drinking Water Concentrations (EDWCs) for the
EBDC degradate ETU for use in an FQPA human health risk assessment. The EBDC fungicides,
Metiram, Maneb and Mancozeb are very short lived in soil and in water and would not themselves
be expected to remain in surface water long enough to reach a location that would supply water for
human consumption whether from surface or groundwater.

Ethylenethiourea (ETU) is a common metabolite of all of the EBDC fungicides and may reach both

surface and groundwater under some conditions. This assessment addresses exposure to ETU only. The **chronic EDWC for surface water is 0.1 ppb** and is based on a monitoring study conducted by the EBDC Task Force. A **range of acute EDWCs** is established with **a lower limit of 0.1 ppb** (based on monitoring) and **an upper limit of 25.2 ppb** (based on environmental fate and transport simulation modeling using the linked EPA PRZM and EXAMS models). The **ground water EDWC is 0.21 ppb** (based on a targeted monitoring study).

The currently approved version of PRZM is only capable of simulating pesticide metabolites through use of simplifying assumptions. The level of uncertainty in the estimated ETU concentration values is therefore relatively high. The targeted surface water monitoring study provides a lower bound for the drinking water exposure estimate. No concentration values above the ETU limit of detection of 0.1 ppb were found in this study. However, acute peak values could have been missed as a result of the 14-day sampling intervals.

The PRZM/EXAMS simulation modeling was performed for 22 crop scenarios. The use patterns for all EBDCs were considered and the highest application rate/lowest application intervals were chosen for modeling. Results indicate that the highest one-in-ten year acute surface water EDWC was found to be 25.2 ppb from the Florida pepper scenario with the lowest value being 4.5 ppb from the North Dakota wheat scenario. The highest chronic concentration value was 1.9 ppb from the California onion scenario with the lowest value being 0.2 ppb from the North Dakota wheat scenario. All these acute and chronic values include adjustment by the *national* maximum default percent cropped area (PCA) value of 0.87. Use of the maximum *regional* PCA values resulted in a reduction of acute/chronic EDWCs and in changes in scenarios giving the lowest/highest values. In this case, the highest one-in-ten year acute surface water EDWCs was 13.9 ppb from California onions scenario with the lowest being 1.4 ppb from Maine potatoes scenario. Both the national and the regional PCA values represent the maximum area planted in any crop. The calculation assumes, not models, very rapid degradation of the parent pesticide to ETU using the maximum observed conversion of parent to ETU in the aerobic soil systems of 9.6% and 23.6% in the water/sediment systems.

Targeted ETU monitoring study showed no surface water concentrations above the detection limit of 0.1 ppb in samples taken pre and post treatment at vulnerable use sites at community drinking intakes in several states. Samples were take every 14 days during the application season for two years. While such sampling could have missed an acute peak value, the Agency believes that it did demonstrate that long-term average chronic values would not exceed the detection limit.

For the purposes of this assessment, the **range of acute EDWC values** for **surface water** at the national level is expected to be **between 0.1 ppb** (the detection limit) **and 25.2 ppb** (the highest peak value from modeling after adjustment by the 0.87 national PCA). The **highest value** in this national level **range** can be reduced to **13.9 ppb** (the highest peak value from modeling after adjustment by the 0.56 California PCA). Both the **chronic/non-cancer** and the **chronic/cancer values** are set conservatively at the **0.1 ppb** detection limit. **The groundwater EDWC concentration is 0.21 ppb** and is derived from a community water system intake concentration

measured during the targeted monitoring study conducted by the EBDC Task Force from 2001 to 2003. In this respect, it is noted that ETU was not detected in any of the treated community drinking water in any of the sampled 84 sites even when it was detected in the raw water. The registrant claims that the absence of ETU in potable water from community water supplies is related to its rapid degradation resulting from aeration and chemical treatment (i.e. chlorination). Home filters containing stages for water softening and particulate removal were reported to be ineffective at removing ETU

Both these surface and groundwater values represent upper-bound conservative estimates of the total ETU residual concentrations that might be found in drinking water derived from either surface water and groundwater sources due to the use of the EBDC fungicides.

Estimating Drinking Water Exposure from Surface Water Sources

i. Combined Monitoring/Modeling Approach
A monitoring program was conducted by the EBDC Task Force from 2001-2003. In this program, raw and associated treated surface water were sampled every two weeks during the three months historical EBDC-application season and quarterly for the remaining three quarters of each year for a period of two years (18 sampling events). A total of 22 sites were chosen to represent vulnerable and high historic EBDC-use sites in the states of Maine (5 sites/potatoes), New York (5 sites/apples), Michigan (total= 6 sites: 3 sites/apples and 3 sites/mixed grapes/apples & nursery plants), Minnesota (2 sites/potatoes), and Washington (4 sites/apples). The results from this targeted monitoring program were used to assign the chronic and the lower limit of the acute EDWCs for drinking water from surface water. Samples were take every 14 days during the application season and acute values may have been missed. Therefore, a **range of acute EDWCs** is established with a lower limit based on monitoring and an upper limit based on environmental fate and transport simulation modeling using the linked EPA PRZM and EXAMS models. The Agency therefore used a combined approach to exposure assessment based on both targeted surface water monitoring and computer simulation to bracket the expected acute exposure level.

1. Targeted monitoring component
Targeted surface water monitoring data was collected by the industry EBDC Task Force. In two years of sampling at sites selected to be the most vulnerable nationally, no concentration values were measured above the method detection limit for ETU of 0.1 ppb. EFED used GIS (Attachment 1) to confirm relevance of surface/groundwater sites to EBDCs use patterns, vulnerability and spatial distribution of the national drinking water intakes. Samples were collected only every two weeks during the usage season and it is possible that daily concentration values above the detection limit may have been missed. The agency does believe, however, that the sampling confirms that long-term average chronic values above the detection limit will not occur.

The Agency has been unable to locate other surface water monitoring data for the EBDC fungicides or for ETU. These chemicals were not included in the US Geological Survey NAWQA sampling program because the test methods are incompatible with the methods used by that program.

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NAWQA measurements are frequently the best national source of pesticide monitoring data. The USGS is currently planning to begin method development and limited EBDC/ETU monitoring in late 2004.

2. Modeling Component
The monitoring-based chronic EDWC of 0.1 ppb may represent the low limit of an acute range of values. Higher acute values can not be ruled out because monitoring was based on a 14-day sampling interval. Therefore, tier II drinking water estimates for ETU in surface water were calculated using the linked USEPA PRZM and EXAMS simulation models. Modeling results were first used to:
(1) Assign a high limit to the acute EDWC range;

(2) Compare chronic values obtained from modeling to the 0.1 ppb value assigned based on monitoring; and

(3) Compare acute/chronic values obtained for monitored areas to other areas of the country where surface water monitoring was not conducted in order to characterize the relevance of EDWC values obtained from monitoring 22 surface water sites for use at the national level.

Modeling Inputs
This calculation assumes very rapid and complete degradation of the parent pesticide to ETU. ETU rate was not based on the molar conversion of 38.5% but rather on the maximum conversion rate of 9.6% observed in the laboratory aerobic soil studies for parent entering the soil system upon application and 23.6% for amounts entering the aquatic system by drift. These conversion rates were arrived at as a result of examination of fate and transport data of parent EBDCs which indicate that ETU is their major transformation product resulting from abiotic and biotic degradation processes in both field and laboratory studies. Reported laboratory data on degradation of EBDCs and the maximum ETU produced are summarized in Table 1.

Table 1. Maximum ETU produced in fate studies for parent EBDCs.

Type of Study	Parent EBDCs Used as a Test Substance (Number of Studies)	Maximum ETU Formed	
		As % Parent Equivalent	As % ETU*
Aqueous Hydrolysis	Maneb (1); Metiram (1)	93.0%	**35.8%**
Aero/Anaerobic Aquatic	Metiram (2); Maneb (1)	61.4%	**23.6%**
Aerobic Soil	Metiram (4); Mancozeb (3); Maneb (3)	24.8%	**09.6%**

* % ETU= % Parent Equivalent multiplied by Molar ratio of ETU to Parent (38.5%). For example the maximum for hydrolysis studies= 93% x 0.385 = 35.8%.

Examination of data indicate that the maximum observed conversion of parent to ETU is expected to be the highest in water systems (35.8%) followed by water/sediment systems (23.6%) and the lowest in aerobic soil systems (9.6%). Although these values represent the maximum found in the laboratory, higher or lower conversion rates may occur in the natural environment depending on the

characteristics of the systems (e.g. availability of moisture and biological activity). This is considered as an uncertainty along with the assumption that conversion to ETU occurs at application. In this respect, it is noted that the maximum ETU attained in the natural environment is a result of two major processes formation and degradation. This maximum is expected to occur shortly after the parent reaches the aquatic system by drift and much longer after foliar applied parent reaches the soil system.

In assigning the value for ETU application rate for modeling, EFED used the parent/ETU conversion value of 9.6% for ETU expected to form (from applied parent) in the soil system. This value (equal to 0.52 kg a.i./ha for apples[1]) was assigned to be the parent equivalent ETU rate. PRZM/EXAMS will use this value to calculate drift by multiplying 0.52 by 0.16 (16% drift). This drift value is accurate only for the soil system and needs to be corrected for the aquatic system. Therefore, a correction factor of 2.458 was used and was affected by changing the drift from 0.16 (the default value) to 0.393. Changing the drift fraction by the stated factor will result in an exact account for the observed 23.6% parent/ETU conversion expected to form (from parent drift) in aquatic systems.

Other inputs used for modeling are the fate and transport parameters determined for the EBDC metabolite/degradate ETU. As shown in Table 2, ETU has an aerobic soil half-life of about 3 days; in the absence of data, the aquatic aerobic metabolism half-life was assumed to be about 6 days, or double the soil half life. The measured anaerobic aquatic metabolism half-life, however, is substantially longer (149 days) possibly leading to the periodic detections in groundwater. It is highly soluble in water (20,000 ppm); highly vulnerable to indirect photolysis (half-life= 1 day), and moderately mobile (288 L/kg). It also has a relatively high vapor pressure but high solubility reduces the possibility of losses from surface water due to volatilization.

Table 2. PRZM/EXAMS Input Parameters for ETU.

Input Parameter	*Value*	*Reference*
Molecular Weight (grams)	102.2	Product chemistry submission
Vapor Pressure (torr)	9.728e-1	Registrant data
Aerobic Soil Metabolism Half-life (days)	3.14	Upper confidence bound on the mean for three soils (MRID 452251-01)
Bacterial Bio-lysis in the water column (days) (Aerobic Aquatic metabolism half-life)	6.28	Aerobic soil t½x2: No aerobic aquatic metabolism study/No significant hydrolysis (Guidance) [1]
Bacterial Bio-lysis in benthic sediment (days) (Anaerobic Aquatic metabolism half-life)	447	Only one value is available= 149 days (MRID 001633-35); use 149x3= 447 days (Guidance) [1]
Application Rate		Varies by crop and calculated from parent rate as described above. Refer to Attachment 2 for a complete list of application rates/dates used in modeling

[1] This value is calculated as follows:
Parent rate (kg/ha)= 5.38 arrived at by multiplying the parent rate of 4.8 (lb/a) by 1.121
ETU rate (kg/ha)= 0.52 arrived at by multiplying the parent rate of 5.38 (kg/ha) by 0.096

Input Parameter	Value	Reference
Application Method	Aerial	Product Label
Depth of Incorporation (inches)	0	Product Label
National Percent Crop Area "PCA" (fraction)	0.87	(Guidance) [1]
Spray Drift (fraction)	0.393	This value is increased from the default value of 0.16 by a factor of 2.458 [2]. This was necessary to account for the difference in maximum conversion of (parent to ETU) between the soil system (9.6%) and the aquatic system (23.6%)
Solubility (mg/L or ppm)	20,000	Product chemistry submission
K_{oc} (L Kg^{-1})	288	Average for ten soils (MRIDs 002588-96& 000971-58)
pH 7 Hydrolysis Half-life (days)	Stable	MRID 404661-03
Photolysis Half-life(days)	1	This is the indirect photolysis half-life reported for ETU; ETU is stable to direct photolysis (MRID 404661-02)

[1]   Guidance for Chemistry and Management Practice Input Parameters For Use in Modeling the Environmental Fate and Transport of Pesticides, Version 2/November 7, 2000.

[2]   This 2.458 correction factor was arrived at by dividing 23.6% (conversion of parent to ETU in aquatic systems) by 9.6% (conversion of parent to ETU in the soil systems which was used as the ETU application rate).

Modeling Outputs

The PRZM/EXAMS simulation modeling was performed for 22 crop scenarios to cover the extensive use patterns for all EBDCS. A Tier II EDWC for a particular crop or use is based on a single index reservoir site that represents a high exposure scenario for use on the crop. The scenarios are indexed to a vulnerable former drinking water reservoir located in Shipman, Illinois. Weather and agricultural practices are simulated at the site for 30 years to estimate the probability of exceeding a given concentration (maximum concentration or average concentration) in a single year. Maximum EDWCs are calculated so that there is a 10% probability that the maximum concentration in a given year will exceed the EDWC at the site. Based on variability of weather, this can also be expressed as an expectation that water concentrations will exceed EDWCs once every 10 years. The results for all model runs are summarized below and background on the model along with complete results, additional inputs and sample outputs are attached for reference (Attachment 2).

Table 3 summarizes results obtained for the highest peak values after adjustment by the national PCA of 0.87 and the regional PCA of 0.56 (California).

Table 3. PRZM/EXAMS highest peak values for the EDWCs of ETU from surface water.

Crop Scenario	PCA	Rates in kg/ha (Number of applications)		EDWC (ppb)
		Parent	ETU	Acute
Peppers (Florida)	0.87	2.69 (6)	0.26 (6)	**25.2**
Almonds (California)	0.56	7.17 (4)	0.69 (4)	**13.9**

Data indicated that the highest peak value from modeling is 25.2 ppb (FL peppers scenario) after adjustment by the 0.87 national PCA. This value is assigned to be the high limit to the acute EDWC range; therefore the range is 0.1 ppb (from monitoring) to 25.2 ppb (from modeling). It is noted however, that the high limit of the range is reduced from 25.2 to 13.9 ppb (CA almonds scenario) after adjustment by associated regional PCA.

Table 4 summarizes modeling results for all runs, at both the national and regional scales, for scenarios representing monitored and non-monitored areas of the country.

Table 4. PRZM/EXAMS values for the EDWCs of ETU from surface water.

State	Crop	Number of monitored Sites	\Representative Crop Scenario	EDWCs (ppb) Adjusted by the National PCA of 0.87			EDWCs (ppb) Adjusted by the Regional PCA [1]		
				Acute	Chronic/ Non-cancer	Chronic/ Cancer	Acute	Chronic/ Non-cancer	Chronic/ Cancer
I. Monitored EBDCs Use Patterns (Areas/Crops)									
ME	Potatoes	5	ME potatoes	8.9	0.9	0.8	1.4	0.1	0.1
NY	Apples	5	PA apples	18.3	1.3	1.1	9.7	0.7	0.6
MI	Apples	3							
			Mixed grapes/apples (two sites) and mixed grapes/nursery plants (one site): No Scenarios are available						
MN	Potatoes	2	ME potatoes	8.9	0.9	0.8	1.4	0.1	0.1
			ID potatoes	6.0	0.7	0.6	4.4	0.5	0.4
WA	Apples	4	OR apples	16.0	1.2	1.1	11.6	0.9	0.8
Overall				**06-18**	**0.7-1.3**	**0.6-1.1**	**01-12**	**0.1-0.9**	**0.1-0.8**

I. Un-monitored EBDCs Use Patterns (Areas/Crops)

| PRZM/EXAMS Scenarios (States/Use Patterns)	EDWCs (ppb) Adjusted by the National PCA of 0.87			EDWCs (ppb) Adjusted by the Regional PCA [1]		
	Acute	Chronic/ Non-cancer	Chronic/ Cancer	Acute	Chronic/ Non-cancer	Chronic/ Cancer

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(1) Highest values: FL peppers; NC apples; FL sweet corn, tomatoes & turf; CAalmonds; PA tomatoes; CA onions; NC peanuts; CA grapes; and FL cabbage.	10-25	0.7-1.9	0.5-1.8	04-14	0.3-1.2	0.2-1.1
(3) Lowest values: MN sugar beet; TX wheat; CA tomatoes; OR sweet corn & wheat; and ND wheat.	05-09	0.2-0.9	0.2-0.8	01-09	0.1-0.7	0.1-0.6
Overall	**05-25**	**0.2-1.9**	**0.2-1.8**	**01-14**	**0.1-1.2**	**0.1-1.1**

As shown in Table 4, PRZM/EXAMS runs predicted EDWCs for ETU to be between 5-25 ppb and chronic values between 0.2-1.9 ppb whereas two years targeted monitoring fails to show any detection over the detection limit of 0.1 ppb. Compared to the monitoring based single 0.1 ppb chronic/non-cancer and chronic/cancer value, modeling results indicate that the range of national scale chronic values is 0.2-1.9 ppb for chronic/non-cancer and 0.2-1.8 ppb for chronic/cancer. The range for these two values are reduced, at the regional level to 0.1-1.2 ppb for chronic/non-cancer and 0.1-1.1 ppb for chronic/cancer.

As shown in the attached GIS maps (Attachment 1), not all possible surface water sites were monitored. Therefore, acute/chronic values obtained for monitored areas were compared to other areas of the country where surface water monitoring was not conducted. The comparison reveals that PRZM/EXAMS predicted acute/chronic ETU/EDWCs for scenarios relevant to use patterns of monitored are relatively higher than those for un-monitored sites (Table 4). In order to further examine the data in leu of the non-detection of ETU, the following assumptions were made:

(1) The chronic value of 0.1 is an acceptable value for monitored sites; and

(2) The change in chronic long-term values is similar to that of the acute (long-term) values. Examination of the chronic/acute results for the 22 runs suggested that the assumption for these runs is reasonable. A plot of acute and chronic concentrations for the current runs reveals a linear relationship with a reasonable R^2 value of 0.58 (Figure 1).

Figure 1. A plot of the relationship between acute and chronic values from 22 PRZM/EXAMS runs.

Chronic Vs. Peak Values

R-square = 0.584   # pts = 22
y = 0.278 + 0.0469x
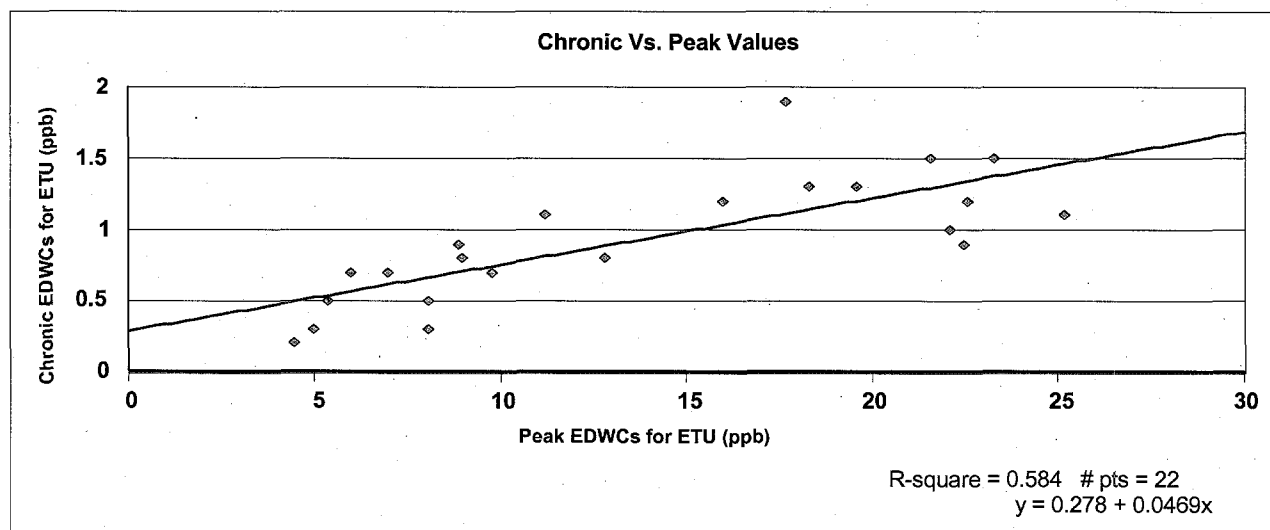
Based on these assumptions, the maximum national/regional acute/chronic values for monitored areas are adjusted proportionally by a factor of 0.0769 (0.1 ppb/1.3 ppb) so that the maximum chronic value for monitored sites is equal to 0.1 ppb. Table 5 shows original and adjusted acute/chronic ETU/EDWCs predicted by PRZM/EXAMS for scenarios relevant to use patterns of monitored and un-monitored sites.

Table 5. Range of original and adjusted values for PRZM/EXAMS acute/chronic ETU/EDWCs.

Sites		National EDWCs (ppb)		Regional EDWCs (ppb)	
		Acute	Chronic	Peak	Chronic
(1) Monitored	Original PRZM/EXAMS values	06-18	0.7-1.3	01-12	0.1-0.9
	Adjusted PRZM/EXAMS values	<1-01	<0.1-0.1	<1-01	<0.1-0.1
(2) Un-monitored	Original PRZM/EXAMS values	05-25	0.2-1.9	01-14	0.1-1.2
	Adjusted PRZM/EXAMS values	<1-02	<0.1-0.2	<1-01	<0.1-0.1

Adjusted values are much lower than the original results from PRZM/EXAMS and the chronic values from all runs are near the assigned value of 0.1 ppb. Additionally, the maximum value of the assigned bracketed range of the acute (0.1-25 ppb) becomes one order of magnitude smaller at both the national (0.1-2 ppb) and the regional scales (0.1-1 ppb).

Surface water targeted monitoring fails to show any detection of ETU above the detection limit 0.1 ppb, however, ETU/EDWCs predicted by PRZM/EXAMS were higher. Reasons that may be given to explain these results include:

- Adjustment of PRZM/EXAMS estimates using PCA values higher than those actually found for some crops;

- In modeling, it was assumed that EBDC parents degrade rapidly and totally to ETU. This is because currently approved version of PRZM is only capable of simulating pesticide metabolites through such simplified assumption giving a relatively high uncertainty in the ETU estimates. Fate data for ETU suggest maximum ETU attained in the natural environment is a result of two major processes: formation and degradation. This maximum is expected to occur shortly after the parent reaches the aquatic system by drift and much longer after foliar applied parent reaches the soil system.
- In modeling, the maximum observed conversion of parent to ETU was used (23.6% for water/sediment systems and 9.6% for the aerobic soil systems). Respective observed minimum values were much lower (1.0% for the aerobic soil systems and 14.9% for water/sediment systems);

- The choice of the date for the first application affects the concentrations estimated by PRZM/EXAMS; EFED selected dates based on information present in the label. EBDCs are applied as protectant fungicides for diseases that appear early and/or late in the season. In most cases, label application dates were set based on the crop growth stage which was used by EFED to choose the appropriate window for the first application.

- The apparent non-sensitivity of PRZM/EXAMS simulations for the photolysis half-life of ETU. Indirect photolysis is reported to be the main reason for non-detection of ETU in surface waters[2]. However, changing the photolysis half-life from stable to 1 day appears not to affect resultant concentrations from PRZM/EXAMS. For example, FL peppers photolysis half-life of 1 day gave concentrations of 25.2 ppb for the acute, 1.1 ppb for the chronic/non-cancer and 0.7 ppb for the chronic/cancer. When photolysis half-life is changed to stable the results were the same for chronic values and almost the same for the acute value (25.4 ppb compared to 25.2 ppb).

ii. Surface Water Conclusions

Based on a combined monitoring and modeling approach, it is concluded that the range of acute values at the national level is expected to be between 0.1 ppb and 25.2 ppb. The highest value in this national level range can be reduced, at the regional level, to 13.9 ppb. Both the chronic/non-cancer and the chronic cancer values were set conservatively at the 0.1 ppb; the detection limit of ETU.

The maximum value at both the national and regional levels are based on the currently approved version of PRZM which is only capable of simulating pesticide metabolites through such simplified assumption giving a relatively high uncertainty. The assigned acute 25.2 and 13.9 ppb values could be as low as 2 and 1 ppb, respectively. These low values are based on the assumption that PRZM/EXAMS acute estimates can be corrected proportionally based on a correction factor so that the maximum chronic value for monitored sites is equal to 0.1 ppb.

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[2] Blazquez, C. H. 1973. J. Agric. Food Chem. 21 (3), 330-332.

# Estimating Drinking Water Exposure from Ground Water Sources

i. Monitoring Approach

1. Community Ground Water Systems
A monitoring program was conducted by the EBDC Task Force from 2001-2003. In this program, raw and associated treated ground water were sampled quarterly for a period of two years (8 sampling events). A total of 84 sites were chosen to represent high historic EBDC-use sites in the states of Maine (7 sites/potato crop), New York (2 sites/apples), Michigan (total= 6 sites: 1 sites/apples, 4 sites mixed grapes & apples, and 1 sites/mixed potato & apples), Minnesota (3 sites/potatoes), Washington (6 sites/apples), California (total= 25 sites: 19 sites/almonds, 4 sites/walnuts, 1 site/almonds & walnuts, 1 site/almonds & grapes), and Florida (total= 35 sites: 13 sites/tomatoes & watermelon, 10 sites/nursery plants & peppers, 6 sites/tomatoes & peppers, 3 sites/tomatoes, 2 sites/potatoes & tomatoes, and 1 site/potatoes). The results from this targeted monitoring program were used to assign the Groundwater Estimated Drinking Water Concentrations (EDWC's) for the EBDC fungicides.

ETU was detected above the detection limit intermittently in only the raw water from two ground water sites (Figure 2). No detection was observed for treated water in any of the 84 community water sites; including those two where ETU was detected in the raw water.

**Figure 2.** Detected concentrations of ETU in two out of 84 community ground water sites.
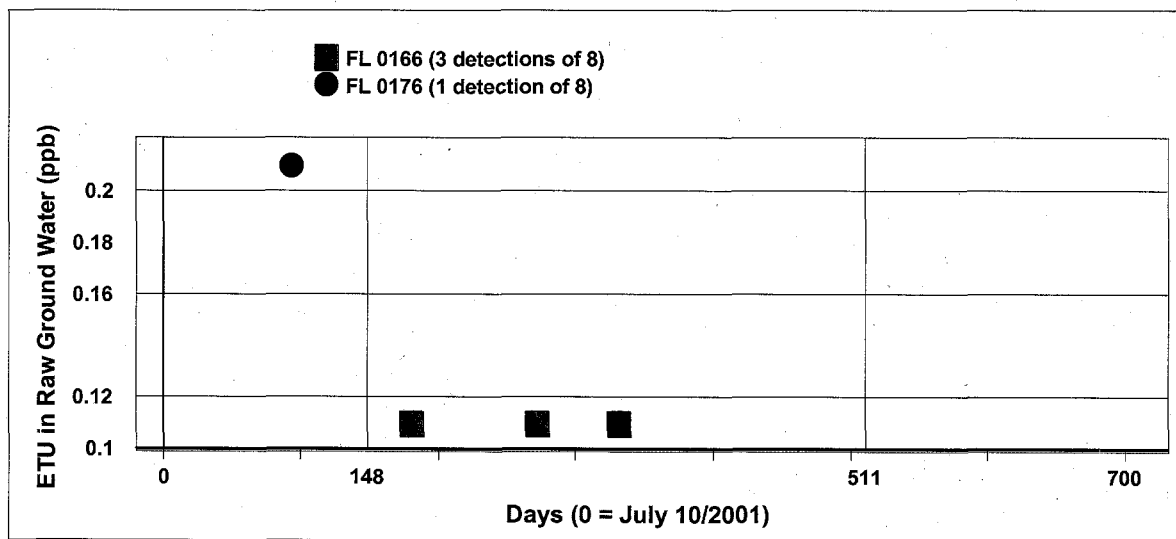
Data indicate that ETU was detected only a few times with the highest detected concentration of 0.21 ppb which was measured for the raw water at FL0176 in Lee County, Florida. No detection was observed over the detection limit of 0.1 ppb for this or any other potable water sample.

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2. Rural Ground Water Wells (Private Wells)

A monitoring program was conducted by the EBDC Task Force from 2001-2003. In this program, raw ground water was sampled monthly for a period of two years (24 sampling events). A total of 125 sites were chosen to represent high historic EBDC-use sites in the states of Maine (9 sites/potato crop), New York (9 sites/apples), Michigan (10 sites/apples), Minnesota (9 sites/potatoes), Washington (7 sites/apples), California (total= 38 sites: 21 sites/almonds, 16 sites/walnuts, 1 site/apples), Illinois and Iowa (total 5 sites: 2 sites/corn & soybeans, 1 site/soybeans and 1 site/corn) and Florida (total= 35 sites: 16 sites/potatoes, 4 sites/tomatoes, 4 sites/squash, 3 sites peppers, and 8 sites mixed).

ETU was detected in the range of 0.10 to 0.25 ppb continuously at 2 sites in Florida and intermittently at six sites: three in Florida and one each in New York, Illinois and Maine (Figure 3). The highest detected ETU concentration of 0.57 ppb was measured for a private well near an EBDC treated field was 0.57 ppb in an apple growing region of New York. No detection of ETU was observed in all the other 117 sites.

Figure 3. Detected concentrations of ETU in eight out of 125 rural ground water sites.
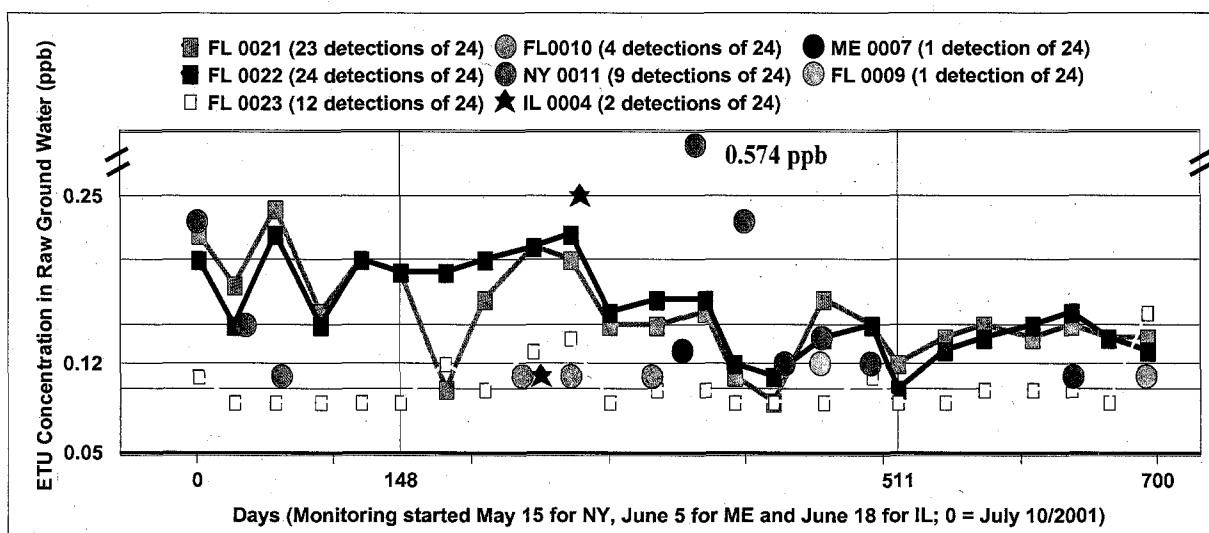
Data indicates that ETU concentrations in the range of 0.1 to 0.25 can occur in shallow ground water sources located within and/or adjacent to field treated with EBDCs; especially when highly permeable materials overlay the water such as the case in Florida. However, in the one well in Illinois, no reason was given to the observed 3 detections within the eight sampling events because EBDCs are not applied at fields at the well location (corn and soybeans). The report did not give any reason to such detections although the source may be related to recharge areas where EBDCs are applied.

It is important to note that the use of home filters containing stages for water softening and

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particulate removal was reported to be ineffective at removing ETU. This was reported by the registrant based on collecting additional filtered samples from only two sites in Florida (FL 0021 and FL 0022).

ii. Modeling Check for Groundwater ETU/EDWCs

The assigned value of 0.21 ppb for ETU/EDWC from ground water, was evaluated for reasonableness by checking it against the high exposure tier one model SCIGROW, which is described in Attachment 2. Maximum application amounts used were: for almonds (4 applications of 6.4 lb a.i/acre EBDC= 4 applications of 0.6144 lb/acre ETU; conversion rate of 0.096) and for papayas (12 applications of 2.0 lb a.i/acre EBDC= 12 applications of 0.192 lb/acre ETU; conversion rate of 0.096). Results indicate that the maximum modeling value of 0.006 ppb is orders of magnitude less than the assigned value of 0.21 ppb which was based on monitoring (Table 6).

Table 6. SCIGROW inputs/outputs based on maximum application rates (almonds and papayas); the average aerobic soil half-lives and lowest Koc value for ETU.

<u>Papaya</u>

SCIGROW
VERSION 2.3
ENVIRONMENTAL FATE AND EFFECTS DIVISION
OFFICE OF PESTICIDE PROGRAMS
U.S. ENVIRONMENTAL PROTECTION AGENCY
SCREENING MODEL
FOR AQUATIC PESTICIDE EXPOSURE

SciGrow version 2.3
chemical: ETU
time is 8/25/2004 13:22: 4

Application rate (lb/acre)	Number of applications	Total Use (lb/acre/yr)	Koc (ml/g)	Soil Aerobic metabolism (days)
0.192	14.0	2.688	3.40E+01	2.1

groundwater screening cond (ppb) = 5.49E-03

<u>Almonds</u>
SciGrow version 2.3
chemical: ETU
time is 8/25/2004 13:23:34

Application rate (lb/acre)	Number of applications	Total Use (lb/acre/yr)	Koc (ml/g)	Soil Aerobic metabolism (days)
0.614	4.0	2.458	3.40E+01	2.1

groundwater screening cond (ppb) = 5.02E-03

iii. Ground Water Conclusions

In the targeted monitoring study carried out by the EBDC Task Force from 2001 through 2003 the highest measured value in a public drinking water well was 0.210 ppb in Lee County, Florida and is used as the maximum value for this assessment. ETU was not detected over the detection limit of 0.1 in any potable water from all ground water samples suggesting possible effects of water treatment.

In rural areas, the highest value measured by the EBDC Task Force was 0.574 ppb and was for ground water from a private well near an EBDC treated field in an apple growing region of New York. ETU concentrations in the range of 0.1 to 0.25 were also measured in 8 out of 125 rural wells. Simple home filtration method was found to be ineffective at removing ETU.

Therefore, exposure to higher ETU concentrations (over the assigned 0.21 ppb) may occur in localities using ground water wells located in proximity or at areas with heavy use of the EBDC fungicides. In this respect, higher groundwater concentration values have been measured but are very rare and are unlikely to represent ground water ETU concentrations expected in drinking water relevant for use in a national assessment. A value of 16 ppb was recorded beneath an Iowa apple orchard which had been treated with an EBDC fungicide. This value far exceeds any values monitored by the task force on the most vulnerable sites nationally and is therefore not believed to represent a true level of risk by the Agency. In 25 years of monitoring in California, there has been only one ETU detection (0.75 ppb). Additionally, ground water monitoring in Holland, resulted in only 8 positive samples with a maximum concentration of 1.5 µg/l (ppb)[3].

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[3] Beitz H et al 1994. In: Chem Plant Prot. Borner H, ed. Germany: Springer-Verlag. 9(Pest Surf Ground Water): 2-56.

Attachment 1: GIS mapping

The objective of the targeted monitoring study was to assess the extent to which historic and concurrent EBDCs use resulted in ETU contamination of drinking water from surface/ground water sources. EFED used GIS maps to confirm relevance of selected surface/ground water sites to EBDCs use patterns (crops and high historical use areas) and vulnerability.
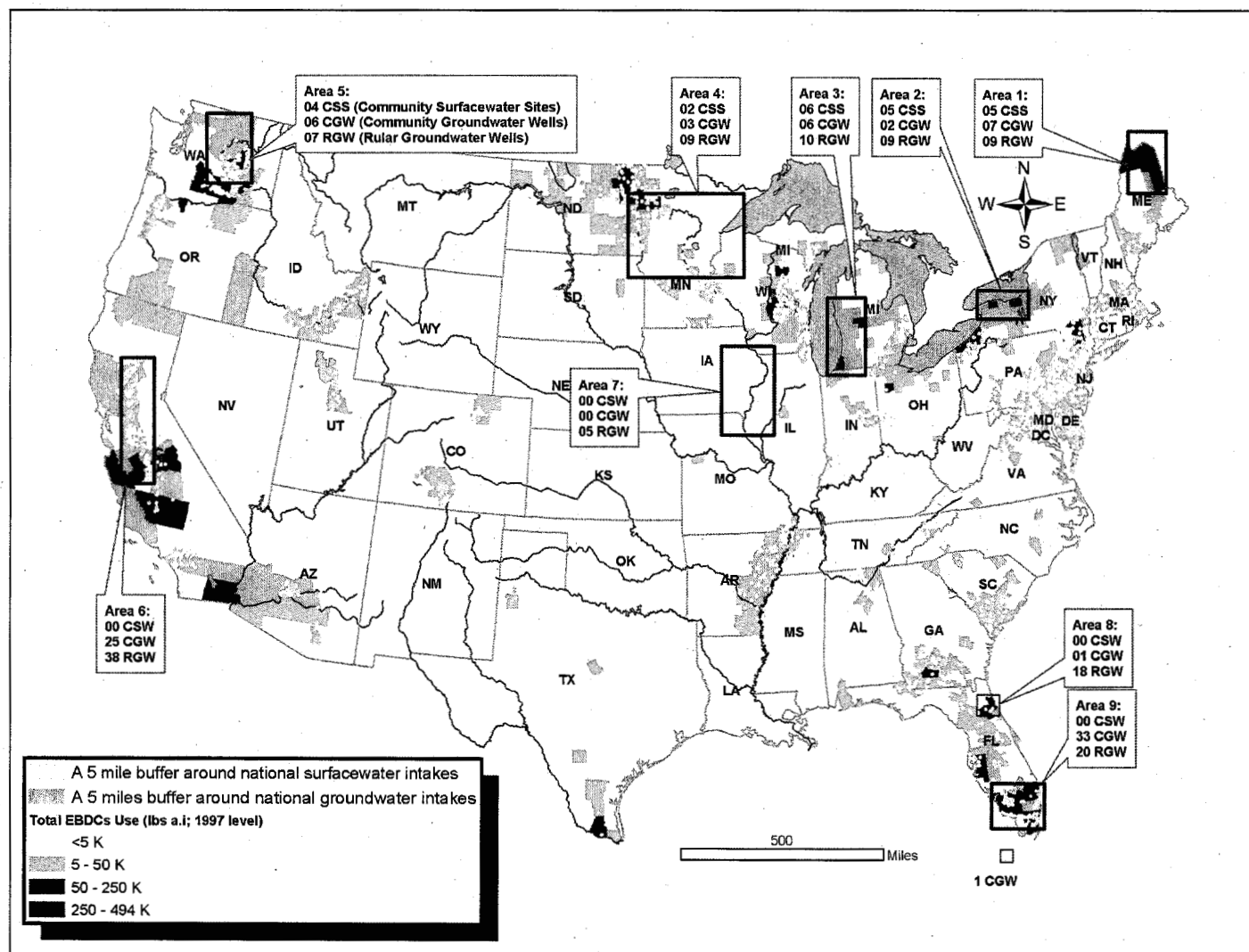
For surface water, the five areas selected for surface water monitoring were associated with maximum historical use level of EBDCs in the Northern States and at least two of these areas (areas 4 to 5) are associated with clusters of surface water intakes (Map 1). All of these areas were cropped with a range of crops representing major crops associated with EBDCs use (Map 2). Examination of the run-off potential for the sites chosen for surface water monitoring reveals that most of these sites were located in run-off vulnerable areas (Map 3). Other potential areas for surface water monitoring are indicated in the map (Map 3, white circles designated by the letters A to L). However, it should be pointed out that the highly vulnerable areas in the states of MS, AR and TN (Map3, designated by the letter J) may not be of concern giving the fact that cotton use will be dropped. Deficiencies in the study include:

(1) Sampling of community surface water sites in large lakes (MI sites from Lake Michigan and NY sites from Lake Ontario); dilution effect.

(2) No surface water sites were monitored in other highly vulnerable and high EBDCs use areas in California and Florida. Predicted PRZM/EXAMS ETU/EDWCs for these un-monitored areas were compared to results obtained for monitored areas. Although values for few scenarios (representing un-monitored crops/areas) were slightly higher than those associated with monitored areas, non-detection of ETU in any of the monitored areas suggests similar results may have been obtained for these un-monitored sites.

For ground water, 209 sites (community and rural ground water wells) were selected for the targeted monitoring study. As shown in Map 1, most of these sites were associated with a relatively high number of ground water intakes and were located in high historic EBDCs use areas. Additionally, all of the major EBDCs-use crops were represented (Map 2). Association of ground water use (represented by intakes) and EBDCs use pattern (crops in Acers/total EBDCs use in lbs) were examined for all monitored sites (Map 4 is an example). Examination reveals that the monitoring program can be used as a basis for this assessment for ground water ETU/EDWCs. However, spatial analysis could have been improved if longitudes/latitudes were given for each well rather than for the nearest city. As shown in Map 4, a single point was used to represent all of the sites near a city.

Map1. A GIS map showing the nine targeted monitoring areas in relation to historic EBDCs use and national surface/ground water intakes.

Area 5:
04 CSS (Community Surfacewater Sites)
06 CGW (Community Groundwater Wells)
07 RGW (Rular Groundwater Wells)

Area 4:
02 CSS
03 CGW
09 RGW

Area 3:
06 CSS
06 CGW
10 RGW

Area 2:
05 CSS
02 CGW
09 RGW

Area 1:
05 CSS
07 CGW
09 RGW

Area 7:
00 CSW
00 CGW
05 RGW

Area 6:
00 CSW
25 CGW
38 RGW

Area 8:
00 CSW
01 CGW
18 RGW

Area 9:
00 CSW
33 CGW
20 RGW

A 5 mile buffer around national surfacewater intakes
A 5 miles buffer around national groundwater intakes

Total EBDCs Use (lbs a.i; 1997 level)
<5 K
5 - 50 K
50 - 250 K
250 - 494 K

500 Miles

1 CGW

Map 2. A GIS map showing total and individual distribution for the major crops and crop groups associated with EBDCs use.

Distribution of Major Crops (blue circles) and Total EBDCs Use On the County level (shades of brown):
Colored circles indicate the crop constituting over 12K of the total:
Green: Vegetables (12-141K acers); Red: Apples (12-75K acers)
Rust: Potatoes (12-66K acres); Violet: Cucurbets (12-36K acers)
and Yellow: Sweet corn (12-33K acres)

Total EBDCs Use (lbs a.i; 1997 level)
<5 K
5 - 50 K
50 - 250 K
250 - 494 K

All major crops (000's Acers)
<3 K
3 - 6 K
6 - 12 K
12 - 400 K

500 Miles

Map 3. A GIS map showing monitored/un-monitored areas, run-off vulnerability, and locations for PRZM/EXAMS scenarios used to compare modeled ETU/EDWCs of monitored with un-monitored areas.
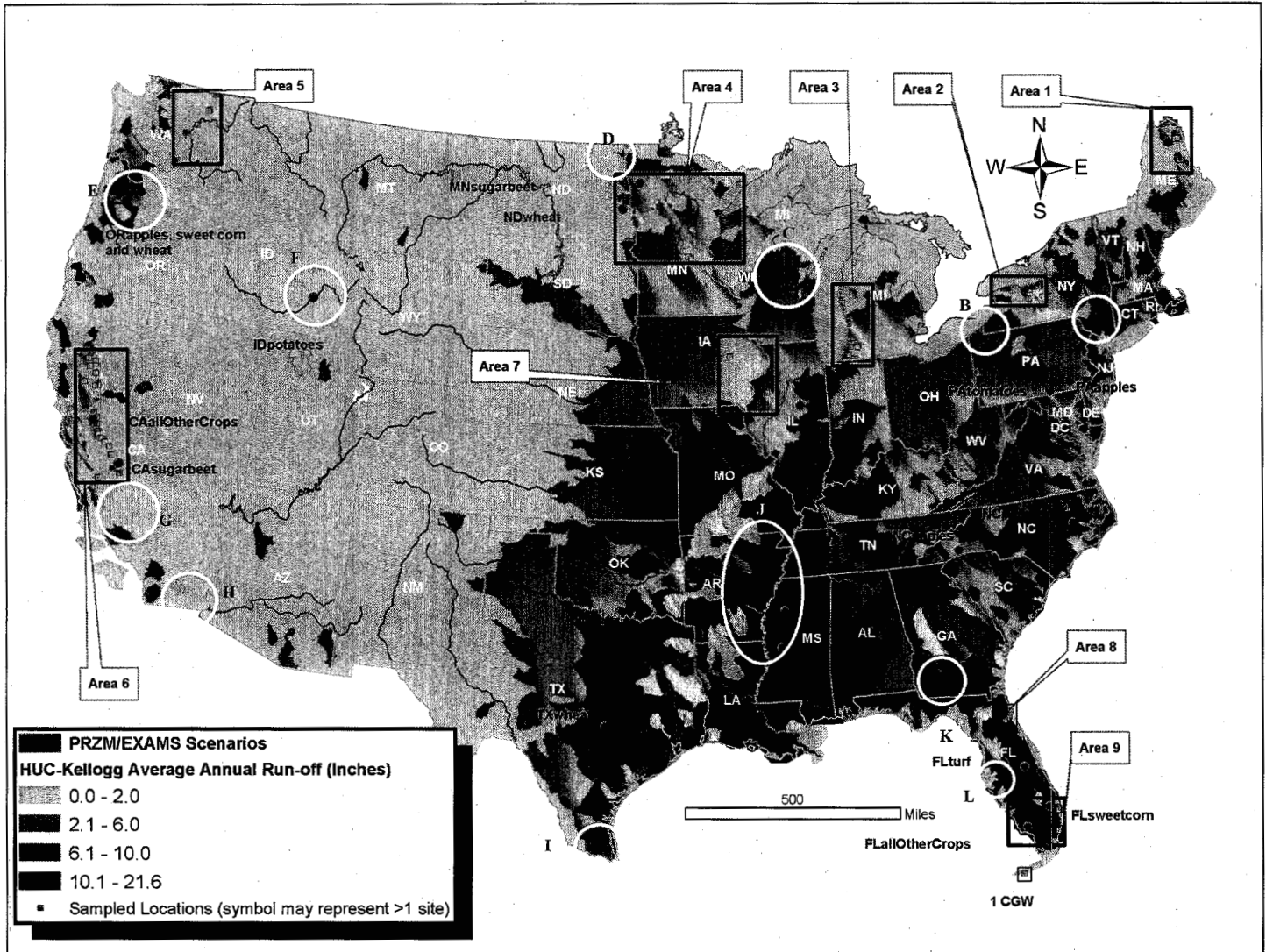
Note: Monitored areas are represented by red boxes and un-monitored areas by white circles.

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Map 4. A GIS map for area 9 shown as an example illustrating examined details (e.g. surface/groundwater sites and county level EBDCs use patterns (Note: many sites share the same point in the map because sites longitudes/latitudes were given to the nearest city).

Area 9: 33 CGW and 20 RGW sites

6 CGW: ETU detected @ 0.21 ppb (1times @ 1 site)

5 CGW: ETU detected @ 0.11 ppb (3 times @ 1 site)
5 RGW: ETU detected 0.11- 0.24 ppb (12-24 times @ 3 sites)

Palm Beach

Hendry

Lee

Broward

Collier

7 CGW

Total EBDCs Use (lbs a.i; 1997 level)
- △ Sampled Rular Ground Water (RGW)
- ● Sampled Comunity Ground Water (CGW)
- <5 K; Use represented by:
- 5 - 50 K County outline color
- 50 - 250 K
- 250 - 494 K
- ● Sampled Community Surface Water
- ● Surface Water Intakes
- ■ Ground Water Intakes
- Urban Areas

Monroe

Miami-Dade

Attachment 2: Modeling

1. PRZM/EXAMS Model inputs/Outputs

a. Summary of additional inputs for various scenarios; other than those listed in Table 2 of the MEMO

PRZM/EXAMS Additional input parameters for various scenarios.

Scenario	Parent EBDC Rate (lbs/a)	kg/ha [1]	ETU Rate kg/ha [2]	Application Date(dd/mm)	Number of Applications	Interval (Days)
Apples NC, Apples PA, and Apples OR (Metiram, Mancozeb and Maneb)	4.80	5.38	0.52	07/03 20/03 15/03	04	7
Tomatoes FL, Tomatoes PA, and Tomatoes CA (Mancozeb)	2.40	2.69	0.26	11/02 06/08 06/07	07	7
Peppers FL (Maneb)	2.40	2.69	0.26	09/10	06	7
Sweet Corn FL, and Sweet Corn OR (Maneb)	1.20	1.35	0.13	07/11 03/07	15 05	3 3
Potatoes ME, Potatoes ID (Maneb)	1.60	1.79	0.17	07/07 15/07	10	5
Wheat TX, Wheat ND, and Wheat OR (Mancozeb)	1.60	1.79	0.17	02/04 24/05 16/04	03	7
Cabbage FL (Maneb)	1.60	1.79	0.17	10/10 01/15	06	7
Grapes CA (Mancozeb and Maneb)	3.2	3.59	0.34	15/02	06	7
Almonds CA (Maneb)	6.4	7.17	0.69	20/03	04	7
Onions CA (Mancozeb and Maneb)	2.40	2.69	0.26	15/03	10	7
Turf FL (Mancozeb and Maneb) [3]	5.8	6.5	0.62	15/03	03	7
Sugar beet CA, and Sugar beet (Mancozeb and Maneb)	1.60	1.79	0.17	01/03 01/08	07	7
Peanuts NC (Mancozeb)	1.80	2.02	0.19	21/03	07	5

[1]   Parent rate (kg/ha)= parent rate (lbs a.i./a) x 1.121.
[2]   ETU rate (kg/ha)= parent rate (kg a.i./ha) x 0.096.
[3]   Assumed three applications (label specify only total rate of 17.4 lbs a.i/a

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b. Summary of all Outputs and Sample of selected Outputs

PRZM/EXAMS modeling results; EDWCs at the national scale.

Scenario	National PCA	Peak	96 hr	21 Day	60 Day	90 Day	Yearly	All Years
FL Peppers	0.87	25.2	20.4	12.9	6.4	4.4	1.1	0.7
NC Apples	0.87	23.3	20.2	15.6	8.6	5.9	1.5	1.2
FL Sweet corn	0.87	22.6	18.3	10.4	6.2	4.1	1.2	0.8
FL Tomatoes	0.87	22.5	17.5	8.5	5.3	3.8	0.9	0.7
FL Turf	0.87	22.1	18.4	11.6	6.0	4.1	1.0	0.7
CA Almonds	0.87	21.6	19.0	14.9	9.0	6.2	1.5	1.3
PA Tomatoes	0.87	19.6	16.3	10.7	7.1	5.2	1.3	0.9
PA Apples	0.87	18.3	15.9	12.8	7.4	5.0	1.3	1.1
CA Onions	0.87	17.7	14.4	11.6	10.0	7.6	1.9	1.8
OR Apples	0.87	16.0	14.0	11.5	6.9	4.8	1.2	1.1
NC Peanuts	0.87	12.8	11.2	8.2	4.7	3.2	0.8	0.6
CA Grapes	0.87	11.2	9.9	8.6	6.1	4.3	1.1	1.0
FL Cabbage	0.87	9.8	8.6	6.1	3.8	2.7	0.7	0.5
MN Sugar beet	0.87	9.0	7.7	5.2	3.7	2.9	0.8	0.6
ME Potatoes	0.87	8.9	7.6	6.0	4.4	3.3	0.9	0.8
TX Wheat	0.87	8.1	6.4	4.0	1.7	1.2	0.3	0.2
CA Sugar beet	0.87	7.0	6.3	5.5	4.0	2.9	0.7	0.6
ID Potatoes	0.87	6.0	4.9	4.3	3.4	2.5	0.7	0.6
CA Tomatoes	0.87	5.4	4.2	3.5	2.7	1.9	0.5	0.4
OR Sweet corn	0.87	5.0	4.2	3.1	1.5	1.1	0.3	0.2
OR wheat	0.87	4.5	4.0	2.9	1.6	1.1	0.3	0.3
ND Wheat	0.87	4.5	3.7	2.7	1.3	0.9	0.2	0.2

PRZM/EXAMS modeling results; EDWCs at the regional scale.

Scenario	Regional PCA	Peak	96 hr	21 Day	60 Day	90 Day	Yearly	All Years
CA Almonds	0.56	13.9	12.2	9.6	5.8	4.0	1.0	0.8
OR Apples	0.63	11.6	10.1	8.3	5.0	3.5	0.9	0.8
CA Onions	0.56	11.4	9.3	7.5	6.4	4.9	1.2	1.1
FL Peppers	0.38	11.0	8.9	5.6	2.8	1.9	0.5	0.3
PA Tomatoes	0.46	10.4	8.6	5.6	3.7	2.7	0.7	0.5
NC Apples	0.38	10.2	8.8	6.8	3.8	2.6	0.6	0.5
FL Sweet corn	0.38	9.9	8.0	4.5	2.7	1.8	0.5	0.3
FL Tomatoes	0.38	9.8	7.7	3.7	2.3	1.6	0.4	0.3
PA Apples	0.46	9.7	8.4	6.8	3.9	2.7	0.7	0.6
FL Turf	0.38	9.7	8.0	5.1	2.6	1.8	0.4	0.3
MN Sugar beet	0.83	8.6	7.4	5.0	3.5	2.7	0.7	0.6
CA Grapes	0.56	7.2	6.3	5.5	3.9	2.8	0.7	0.7

Scenario	Regional PCA	Peak	96 hr	21 Day	60 Day	90 Day	Yearly	All Years
TX Wheat	0.67	6.2	4.9	3.1	1.3	0.9	0.2	0.1
NC Peanuts	0.38	5.6	4.9	3.6	2.0	1.4	0.3	0.3
CA Sugar beet	0.56	4.5	4.1	3.5	2.6	1.8	0.5	0.4
ID Potatoes	0.63	4.4	3.6	3.1	2.5	1.8	0.5	0.4
FL Cabbage	0.38	4.3	3.8	2.6	1.7	1.2	0.3	0.2
OR Sweet corn	0.63	3.6	3.0	2.3	1.1	0.8	0.2	0.2
CA Tomatoes	0.56	3.5	2.7	2.2	1.7	1.2	0.3	0.3
OR wheat	0.63	3.3	2.9	2.1	1.2	0.8	0.2	0.2
ND Wheat	0.56	2.9	2.4	1.7	0.8	0.6	0.1	0.1
ME Potatoes	0.14	1.4	1.2	1.0	0.7	0.5	0.1	0.1

Florida peppers scenario

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:

Output File: ETUDW

Metfile:	w12844.dvf			
PRZM scenario:	FLpeppersC.txt			
EXAMS environment file:	ir298.exv			
Chemical Name:	ETU			
Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	102.2	g/mol	
Henry's Law Const.	henry		atm-m^3/mol	
Vapor Pressure	vapr	9.73E-01	torr	
Solubility	sol	20000	mg/L	
Kd	Kd		mg/L	
Koc	Koc	288	mg/L	
Photolysis half-life	kdp	1	days	Half-life
Aerobic Aquatic Metabolism	kbacw	6.28	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	447	days	Halfife
Aerobic Soil Metabolism	asm	3.14	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.26	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.393	fraction of application rate applied to pond	
Application Date	Date	10-09	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	7	days	Set to 0 or delete line for single app.
Interval 2	interval	7	days	Set to 0 or delete line for single app.
Interval 3	interval	7	days	Set to 0 or delete line for single app.
Interval 4	interval	7	days	Set to 0 or delete line for single app.
Interval 5	interval	7	days	Set to 0 or delete line for single app.

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Record 17:	FILTRA	
	IPSCND	1
	UPTKF	
Record 18:	PLVKRT	
	PLDKRT	
	FEXTRC	0.5
Flag for Index Res. Run	IR	IR
Flag for runoff calc.	RUNOFF	total none, monthly or total(average of entire run)

Outputs
stored as ETUDW.out
Chemical: ETU
PRZM environment: FLpeppersC.txt modified Satday, 12 October 2002 at 16:41:28
EXAMS environment: ir298.exv modified Thuday, 29 August 2002 at 15:34:12
Metfile: w12844.dvf modified Wedday, 3 July 2002 at 09:04:30
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	7.7	5.74	4.839	3.173	2.142	0.5281
1962	7.703	5.699	4.228	2.898	1.971	0.4919
1963	15.02	11.21	6.364	4.25	2.882	0.7171
1964	19.61	14.79	9.273	7.331	5.039	1.248
1965	36.65	28.79	15.19	8.985	6.055	1.509
1966	10.11	7.864	5.344	3.448	2.337	0.5942
1967	11.91	8.921	5.825	3.524	2.382	0.5947
1968	13.14	10.79	7.101	4.35	2.955	0.7344
1969	12.44	9.092	7.65	4.679	3.199	0.7983
1970	6.327	5.053	3.942	2.742	1.863	0.4707
1971	13.48	11.21	7.543	4.151	2.794	0.6951
1972	55.22	42.08	18.65	8.196	5.543	1.371
1973	5.815	4.402	3.676	2.873	1.946	0.497
1974	9.919	7.623	4.724	3.692	2.535	0.6306
1975	7.429	5.699	4.35	2.914	1.977	0.4955
1976	11.26	9.591	6.419	4.213	2.883	0.7151
1977	7.135	5.475	4.491	3.433	2.386	0.5983
1978	25.5	20.22	11.59	6.121	4.148	1.032
1979	12.29	9.137	5.713	3.514	2.386	0.6012
1980	6.644	5.686	4.227	3.245	2.208	0.5505
1981	17.59	14.71	8.107	4.427	3.01	0.7496
1982	29.11	22.25	15.64	7.333	4.957	1.232
1983	22.7	17.06	10.35	5.537	3.75	0.9407
1984	28.09	23.54	10.72	6.728	4.779	1.187
1985	5.691	4.291	3.442	2.441	1.65	0.4276
1986	11.03	8.242	6.276	4.122	2.786	0.6923

	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1987	21.21	17.19	9.183	5.279	3.566	0.8874
1988	8.881	7.147	5.173	3.032	2.044	0.513
1989	8.347	6.427	4.909	3.288	2.221	0.5533
1990	6.274	4.55	3.563	2.525	1.703	0.4257

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258065	55.22	42.08	18.65	8.985	6.055	1.509
0.064516129	36.65	28.79	15.64	8.196	5.543	1.371
0.096774194	29.11	23.54	15.19	7.333	5.039	1.248
0.129032258	28.09	22.25	11.59	7.331	4.957	1.232
0.161290323	25.5	20.22	10.72	6.728	4.779	1.187
0.193548387	22.7	17.19	10.35	6.121	4.148	1.032
0.225806452	21.21	17.06	9.273	5.537	3.75	0.9407
0.258064516	19.61	14.79	9.183	5.279	3.566	0.8874
0.290322581	17.59	14.71	8.107	4.679	3.199	0.7983
0.322580645	15.02	11.21	7.65	4.427	3.01	0.7496
0.35483871	13.48	11.21	7.543	4.35	2.955	0.7344
0.387096774	13.14	10.79	7.101	4.25	2.883	0.7171
0.419354839	12.44	9.591	6.419	4.213	2.882	0.7151
0.451612903	12.29	9.137	6.364	4.151	2.794	0.6951
0.483870968	11.91	9.092	6.276	4.122	2.786	0.6923
0.516129032	11.26	8.921	5.825	3.692	2.535	0.6306
0.548387097	11.03	8.242	5.713	3.524	2.386	0.6012
0.580645161	10.11	7.864	5.344	3.514	2.386	0.5983
0.612903226	9.919	7.623	5.173	3.448	2.382	0.5947
0.64516129	8.881	7.147	4.909	3.433	2.337	0.5942
0.677419355	8.347	6.427	4.839	3.288	2.221	0.5533
0.709677419	7.703	5.74	4.724	3.245	2.208	0.5505
0.741935484	7.7	5.699	4.491	3.173	2.142	0.5281
0.774193548	7.429	5.699	4.35	3.032	2.044	0.513
0.806451613	7.135	5.686	4.228	2.914	1.977	0.497
0.838709677	6.644	5.475	4.227	2.898	1.971	0.4955
0.870967742	6.327	5.053	3.942	2.873	1.946	0.4919
0.903225806	6.274	4.55	3.676	2.742	1.863	0.4707
0.935483871	5.815	4.402	3.563	2.525	1.703	0.4276
0.967741935	5.691	4.291	3.442	2.441	1.65	0.4257
0.1	29.008	23.411	14.83	7.3328	5.0308	1.2464

EDWC for ETU; Fl peppers				Average of yearly averages:		0.749377
Adj for National PCA (0.87)	**25.2**	**20.4**	**12.9**	**6.4**	**4.4**	**1.1**
						0.7
Adj for Regional PCA (0.38)	**11.0**	**8.9**	**5.6**	**2.8**	**1.9**	**0.5**
				Average of yearly averages:		**0.3**

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California almonds scenario

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: ETUDW
Metfile: w23232.dvf
PRZM scenario: CAalmondC.txt
EXAMS environment file: ir298.exv
Chemical Name: ETU

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	102.2	g/mol	
Henry's Law Const.	henry		atm-m^3/mol	
Vapor Pressure	vapr	9.73E-01	torr	
Solubility	sol	20000	mg/L	
Kd	Kd		mg/L	
Koc	Koc	288	mg/L	
Photolysis half-life	kdp	1	days	Half-life
Aerobic Aquatic Metabolism	kbacw	6.28	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	447	days	Halfife
Aerobic Soil Metabolism	asm	3.14	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.69	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.393	fraction of application rate applied to pond	
Application Date	Date	20-03	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	7	days	Set to 0 or delete line for single app.
Interval 2	interval	7	days	Set to 0 or delete line for single app.
Interval 3	interval	7	days	Set to 0 or delete line for single app.
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		
Flag for Index Res. Run	IR	IR		
Flag for runoff calc.	RUNOFF	total	none, monthly or total(average of entire run)	

Outputs
stored as ETUDW.out
Chemical: ETU
PRZM environment: CAalmondC.txt   modified Satday, 12 October 2002 at 16:30:38
EXAMS environment: ir298.exv   modified Thuday, 29 August 2002 at 15:34:12
Metfile: w23232.dvf   modified Wedday, 3 July 2002 at 09:04:22

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Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	20.64	17.54	14.25	8.026	5.454	1.361
1962	20.73	17.6	14.41	8.088	5.497	1.379
1963	28.25	24.98	23.19	13.28	9.107	2.282
1964	20.48	17.37	14.12	7.925	5.386	1.346
1965	21.99	18.89	14.98	8.601	5.845	1.465
1966	20.03	16.79	13.85	7.597	5.143	1.287
1967	24.87	21.97	17.22	10.44	7.144	1.787
1968	20.29	17.14	13.98	7.788	5.284	1.319
1969	24.24	20.76	16.27	9.238	6.266	1.567
1970	20.94	18	14.34	8.223	5.57	1.393
1971	21.02	18.04	14.48	8.333	5.68	1.422
1972	20.38	17.34	13.9	7.859	5.333	1.331
1973	20.17	16.96	13.97	7.684	5.192	1.298
1974	21.14	18.18	14.58	8.408	5.726	1.441
1975	22.44	19.45	16.15	9.532	6.454	1.613
1976	22.73	19.43	14.75	8.427	5.694	1.42
1977	19.84	16.6	13.63	7.527	5.122	1.282
1978	21.42	18.53	14.71	8.655	5.874	1.47
1979	22.01	18.93	15.81	8.9	6.034	1.51
1980	20.6	17.47	14.29	8.012	5.445	1.36
1981	21.15	18.14	14.66	8.405	5.716	1.429
1982	37.54	33.24	22.57	12.85	8.764	2.197
1983	21.48	18.53	14.97	9.014	6.154	1.542
1984	20.01	16.94	13.54	7.554	5.102	1.272
1985	20.49	17.29	14.28	7.91	5.362	1.342
1986	20.87	17.87	14.09	8.073	5.482	1.372
1987	20.23	17.05	13.96	7.707	5.207	1.303
1988	20.53	17.53	13.99	8.628	5.881	1.467
1989	20.29	17.12	14.04	7.799	5.284	1.373
1990	20.01	16.76	13.84	7.607	5.438	1.367

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258065	37.54	33.24	23.19	13.28	9.107	2.282
0.064516129	28.25	24.98	22.57	12.85	8.764	2.197
0.096774194	24.87	21.97	17.22	10.44	7.144	1.787
0.129032258	24.24	20.76	16.27	9.532	6.454	1.613
0.161290323	22.73	19.45	16.15	9.238	6.266	1.567
0.193548387	22.44	19.43	15.81	9.014	6.154	1.542
0.225806452	22.01	18.93	14.98	8.9	6.034	1.51
0.258064516	21.99	18.89	14.97	8.655	5.881	1.47

0.290322581	21.48	18.53	14.75	8.628	5.874	1.467
0.322580645	21.42	18.53	14.71	8.601	5.845	1.465
0.35483871	21.15	18.18	14.66	8.427	5.726	1.441
0.387096774	21.14	18.14	14.58	8.408	5.716	1.429
0.419354839	21.02	18.04	14.48	8.405	5.694	1.422
0.451612903	20.94	18	14.41	8.333	5.68	1.42
0.483870968	20.87	17.87	14.34	8.223	5.57	1.393
0.516129032	20.73	17.6	14.29	8.088	5.497	1.379
0.548387097	20.64	17.54	14.28	8.073	5.482	1.373
0.580645161	20.6	17.53	14.25	8.026	5.454	1.372
0.612903226	20.53	17.47	14.12	8.012	5.445	1.367
0.64516129	20.49	17.37	14.09	7.925	5.438	1.361
0.677419355	20.48	17.34	14.04	7.91	5.386	1.36
0.709677419	20.38	17.29	13.99	7.859	5.362	1.346
0.741935484	20.29	17.14	13.98	7.799	5.333	1.342
0.774193548	20.29	17.12	13.97	7.788	5.284	1.331
0.806451613	20.23	17.05	13.96	7.707	5.284	1.319
0.838709677	20.17	16.96	13.9	7.684	5.207	1.303
0.870967742	20.03	16.94	13.85	7.607	5.192	1.298
0.903225806	20.01	16.79	13.84	7.597	5.143	1.287
0.935483871	20.01	16.76	13.63	7.554	5.122	1.282
0.967741935	19.84	16.6	13.54	7.527	5.102	1.272
0.1	24.807	21.849	17.125	10.3492	7.075	1.7696
EDWC for ETU; CA Almonds				Average of yearly averages:		1.466567
Adj for National PCA (0.87)	**21.6**	**19.0**	**14.9**	**9.0**	**6.2**	**1.5**
						1.3
Adj for Regional PCA (0.56)	**13.9**	**12.2**	**9.6**	**5.8**	**4.0**	**1.0**
				Average of yearly averages:		**0.8**

2. Background Information on the modeling

a. PRZM and EXAMS models and the Index Reservoir Scenario

The linked PRZM and EXAMS models are used in this case as a second tier screen designed to estimate the pesticide concentrations found in water for use in drinking water assessments. They provide high-end values on the concentrations that might be found in a small drinking water reservoir due to the use of pesticide. The Drinking Water Index Reservoir scenario includes a 427 acres field immediately adjacent to a 13 acres reservoir, 9 feet deep, with continuous site-specific flow. This amount can be reduced due to degradation in field and the effect of binding to soil. Spray drift is equal to 6.4% of the applied concentration from the ground spray application and 16% for aerial applications.

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The PRZM/EXAMS modeling system with the Index Reservoir scenario also makes adjustments for the percent cropped area. While it is assumed that the entire watershed would not be treated, the use of a PCA is still a screen because it represents the highest percentage of crop cover of any large watershed in the US, and it assumes that the entire crop is being treated. Various other conservative assumptions of this scenario include the use of a small drinking water reservoir surrounded by a runoff-prone watershed, the use of the maximum use rate and no buffer zone.

b. SCIGROW

SCI-GROW is a screening model which the Office of Pesticide Programs (OPP) in EPA frequently uses to estimate pesticide concentrations in vulnerable ground water. The model provides an exposure value which is used to determine the potential risk to the environment and to human health from drinking water contaminated with the pesticide. The SCI-GROW estimate is based on environmental fate properties of the pesticide (aerobic soil degradation half-life and linear adsorption coefficient normalized for soil organic carbon content), the maximum application rate, and existing data from small-scale prospective ground-water monitoring studies at sites with sandy soils and shallow ground water.

Pesticide concentrations estimated by SCI-GROW represent conservative or high-end exposure values because the model is based on ground-water monitoring studies which were conducted by applying pesticides at maximum allowed rates and frequency to vulnerable sites (i.e., shallow aquifers, sandy, permeable soils, and substantial rainfall and/or irrigation to maximize leaching). In most cases, a large majority of the use areas will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimate. SCIGROW provides a groundwater screening exposure value to be used in determining the potential risk to human health from drinking water contaminated with the pesticide. SCIGROW estimates likely groundwater concentrations if the pesticide is used at the maximum allowable rate in areas where groundwater is exceptionally vulnerable to contamination. In most cases, a large majority of the use area will have groundwater that is less vulnerable to contamination than the areas used to derive the SCIGROW estimate.